

**From:** Brooks, George P CIV NAVFAC SW, PACO  
**To:** [Johnson, Robert L.](#); [Picel, Kurt C.](#)  
**Cc:** [Whitcomb, James H CIV NAVFAC SW](#)  
**Subject:** FW: Gross gamma measurements  
**Date:** Friday, September 16, 2011 10:41:27 AM  
**Importance:** High

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Hi Bob and Kurt, I am forwarding this email from Kurt Jackson from California Department of Public Health (CDPH) that recognizes the problems using a single reference area to calculate and apply the mean + 3 sigma screening criteria to a variety of soil types. I believe the main point is that the regulatory agencies will be open to changes in our methods and procedures.

-----Original Message-----

From: Whitcomb, James H CIV NAVFAC SW  
Sent: Thursday, September 08, 2011 12:23  
To: Brooks, George P CIV NAVFAC SW, PACO  
Subject: FW: Gross gamma measurements  
Importance: High

Pat-I know it is a lot to read, but attached are the comments from CDPH "Kurt Jackson" I believe they are very relevant to our overall goal of improving our waste identification and characterization.

-----Original Message-----

From: Whitcomb, James H CIV NAVFAC SW  
Sent: Saturday, March 19, 2011 14:37  
To: 'Jackson, Kurt (CDPH-DDWEM)'  
Cc: 'RMiya@dtsc.ca.gov'; 'Jue, Tracy (CDPH-DDWEM)'  
Subject: RE: Gross gamma measurements

Kurt,

I really appreciate your thoughts on this issue your observations and insight will be very helpful I plan on sharing this with the team and determine how we can apply this which shouldn't be difficult considering the amount of sample data we have collected.

V/r

Jim

-----Original Message-----

From: Jackson, Kurt (CDPH-DDWEM) [<mailto:Kurt.Jackson@cdph.ca.gov>]  
Sent: Saturday, March 19, 2011 11:53  
To: Whitcomb, James H CIV NAVFAC SW  
Cc: RMiya@dtsc.ca.gov; Jue, Tracy (CDPH-DDWEM)  
Subject: Gross gamma measurements

Jim:

We have discussed and I offered to send some notes regarding the situation where HPS collects and analyzes soil samples when a gross gamma result exceeds three sigma above the mean of a reference area data set. This value is essentially used as a sewer project action level that causes collection of additional soil samples. As pointed out in responses to previous CDPH comments, this approach is specified in project documents, so using this action level meets the project document specifications.

However, the data sets provided in sewer survey unit project reports (SUPRs) indicate that the selected reference

area data set does not match many of the survey units data sets even when subsequent sampling does not find elevated levels. And this is not too surprising since we have seen a wide range of visible differences in soil samples from the sewer project. One can see this very clearly in photographs of the 35 samples that our laboratory analyzed from the sewer project last year.

Another indication that the reference area data set often does not match the survey unit data set is the difference in the mean values and standard deviations of survey unit results compared to the selected reference area.

This shows up in reports where many or most values in the survey unit are above or below the mean plus or minus three sigma of the reference data set.

The approach being used where the mean plus three sigma of the reference area data set is used as the action level has some assumptions behind it. First, it assumes that a survey unit without significant contamination will produce gross gamma results comparable to the reference area. Second, it assumes that the distribution shape will be similar. The second assumption may be met.

The first assumption is clearly not being met since survey unit data supported by sample data indicate that some survey units that show no contamination have many gross gamma results above the action level. In other cases most or all of the gross gamma results in a survey unit data set are below the mean of reference area data set.

When this situation occurs, what is often done is to set the action level at three sigma above the mean value of the survey unit being measured. That action level essentially picks up outliers from the survey unit and assumes that if the action level is not triggered, then the survey unit has a relatively uniform distribution of results or fits a normal distribution reasonably well. The advantage to such an approach is that it does not rely on the match to the reference area mean and standard deviation.

However, to use that approach one would want a way to see that the survey unit did not have a bi-modal or skewed distribution. I suspect that a simple way to check that is to look at the relative standard deviation or standard deviation of the survey unit divided by the mean of the survey unit. I suspect that for survey units shown to be adequately remediated or uncontaminated that the relative standard deviation of the gross gamma results would fall within a fairly narrow range that could be used to check the distribution before using its mean plus three sigma as an action level.

So, the procedure that might be tried out on existing survey unit data is:

Calculate the relative standard deviation (RSD) for a number of survey units that are not contaminated and establish a range of typical of values.

Then for a survey unit of interest, calculate the RSD and see if it falls within that range.

If it does, then set the action level for collection of samples at the mean plus three sigma of the survey unit.

If the survey unit RSD falls outside the range, create a frequency distribution and CFD plot for the survey unit and select biased sampling points where gross gamma data does not appear to be part of a normal or typical distribution. This would require that you had frequency distributions and CFD plots for several survey units that were not contaminated for comparison.

The approach could be tried on some of the survey units where the gross gamma data has resulted in many additional samples based on the existing criteria, but the resulting sample results have shown little or no contamination. Note that the RSD calculation may not be the best approach for checking the distribution...a good question for your statistician.

The reasons for looking at the approach being used is that the existing approach may be causing additional sampling that is not needed and it also may be failing to cause needed sampling in other cases.